Life Support Flow With Phase Change

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Needs that drive research

- μg condenser
- evaporator
- water purification
- temperature/humidity control
- urine processing
- food storage (refrigeration)
- material processing

Current Level of Understanding

- empirical data for specific configurations
- boiling in tubes – some models
- boiling on wire – data available

Life Support
Flow With Phase Change Continued

Desired Outcome (improve understanding)

Near Term (N)	Heat transfer effectiveness prediction
Mid Term (M)	Fluid flow topology
Mid Term (M)	Quantification of non-condensing gas effects
Long Term (L)	Scale rules for fractional gravity
Long Term (L)	Non-equilibrium and coupled effects on flow

Benefits

- Optimized design
- Improved effectiveness
- System reliability

Cross Cutting

- ISRU
- Thermal Management
- Power

Emerging/Alternate Technologies Applicable to Life Support

Needs that Drive the Topic

- Improving system performance
- Reduced weight, power, volume

- Thermo acoustic systems
- Flow control with:
  - Electric fields
  - Acoustics
  - Magnetic
  - Active geometry
- Microchannel reactors and heat exchanges

Current Technical Base

- Feasibility testing under 1'g'

Desired Outcome – (Improved understanding)

M Understanding fundamental physics of processes
N Determine gravity independence
L Test Life Support applications

Emerging/Alternate Technologies Applicable to Life Support Continued

Benefits

- Reduced gravity effects
- Improved system performance

Cross-cutting

Terrestrial applications

Life Support
Multi-Phase Flow in Packed Beds

Needs:

- Water processing – catalytic beds
- Bio reactors – reduced expendables

Current Knowledge Base:

Empirical data

Models for 2ϕ flow in pipes

Desired Outcome (Improvements)

M Development of flow regime map

N Pressure drop prediction

N Gas/Liquid Distribution

L Math model – predictive

L Addition of chemical reaction to model

Life Support
Multi-Phase Flow in Packed Beds Continued

Benefits:

- Optimized design
- Reduced bed size
- Reliability improvement
- Reduced development cost

Cross-cutting:

- Commercial chemical bed design
- ISRU